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RESEARCH ARTICLE

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A curious new *Coenosia* Meigen, 1826 (Diptera, Muscidae) from Mariepskop, Mpumalanga, South Africa

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Abstract

A new species of *Coenosia* Meigen, 1826 is described, *C. flagelliseta* **sp. nov.**, belonging to a new aberrant group with apically globular orbital setae, previously only known from male specimens in two species. A female from this unique group is also described for the first time, having tergite 6 of the ovipositor atypical for the Coenosiini. The affinities of the group and the species within are discussed.

Keywords

Diptera, Muscidae, *Coenosia*, new species, Afrotropical, South Africa.

Introduction

Coenosia Meigen, 1826 is considered one of the most speciose genera of muscids in the world, with more than 120 species occurring in the Afrotropical Region (Couri and Pont 2016) and distributed throughout all biogeographic regions except the Antarctic.

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South Africa has approximately 32 species of *Coenosia* recorded (Pont 1980), with more awaiting identification in collections. Even though ca. 25% of known Afrotropical species are recorded from South Africa, it is important to note that, for large parts of the country, the *Coenosia* fauna is still unknown. Van Emden (1940) subdivided the species of Afrotropical *Coenosia* into seven informal groups. The three species of *Coenosia* treated herein are grouped together in a new "*globuliseta*-group" for future reference. Muller and Miller (2013) described a striking new species, *C. macrotriseta* Muller & Miller, 2013, which shared affinities with *C. globuliseta* Pont, 1980, both having unique apically globular orbital setae. A new species, *Coenosia flagelliseta* sp. nov. is described herein and shares the same type of characteristic setae, so far unique to only these three species within the *Coenosia*. The female of the new species is also described, thus far unknown for the members of this group. The morphological oddities of this group are also compared to others in *Coenosia* and briefly discussed, as is the habitat and potential feeding strategies.

Material and methods

Locality and collection methods

Material from Mariepskop State Forest was sampled using a licence from the Department of Agriculture, Forestry and Fisheries, South Africa. All specimens were sampled together in one Gressitt & Gressitt-style Malaise trap erected over a ravine (arrowed) on Mariepskop (Figs 1, 2), one of the highest peaks in the northern Drakensberg Mountains of South Africa.

Specimen treatment

Specimens were dissected and macerated in 10% potassium hydroxide (KOH). Photographs were taken with a Leica EZ4 stereomicroscope and built-in 5MP camera and stacked using Adobe Photoshop CC 2019. Line drawings were made using a Zeiss microscope with drawing tube and digitally inked using Adobe Illustrator CC 2019. Drawings and photos of *C. globuliseta* and *C. macrotriseta* are reused or modified from Muller and Miller (2013).

Material examined cites the labels directly, with additional author-interpreted information provided in brackets.

Morphological terminology follows that of Cumming and Wood (2017), with the exception of the term "cercal plate", which is used by workers of Muscidae to describe what is termed the cercus of male terminalia in Cumming and Wood (2017). Additional information on material examined is given where possible in brackets. Vegetation type information was derived from Mucina and Rutherford (2006), with the species distribution map generated in QGIS 3.4.5.

Figures 1, 2. Mariepskop study site **1** northern Escarpment Fynbos vegetation. Ravine indicated by white arrow **2** ravine with erected Gressitt & Gressitt-style Malaise Trap.

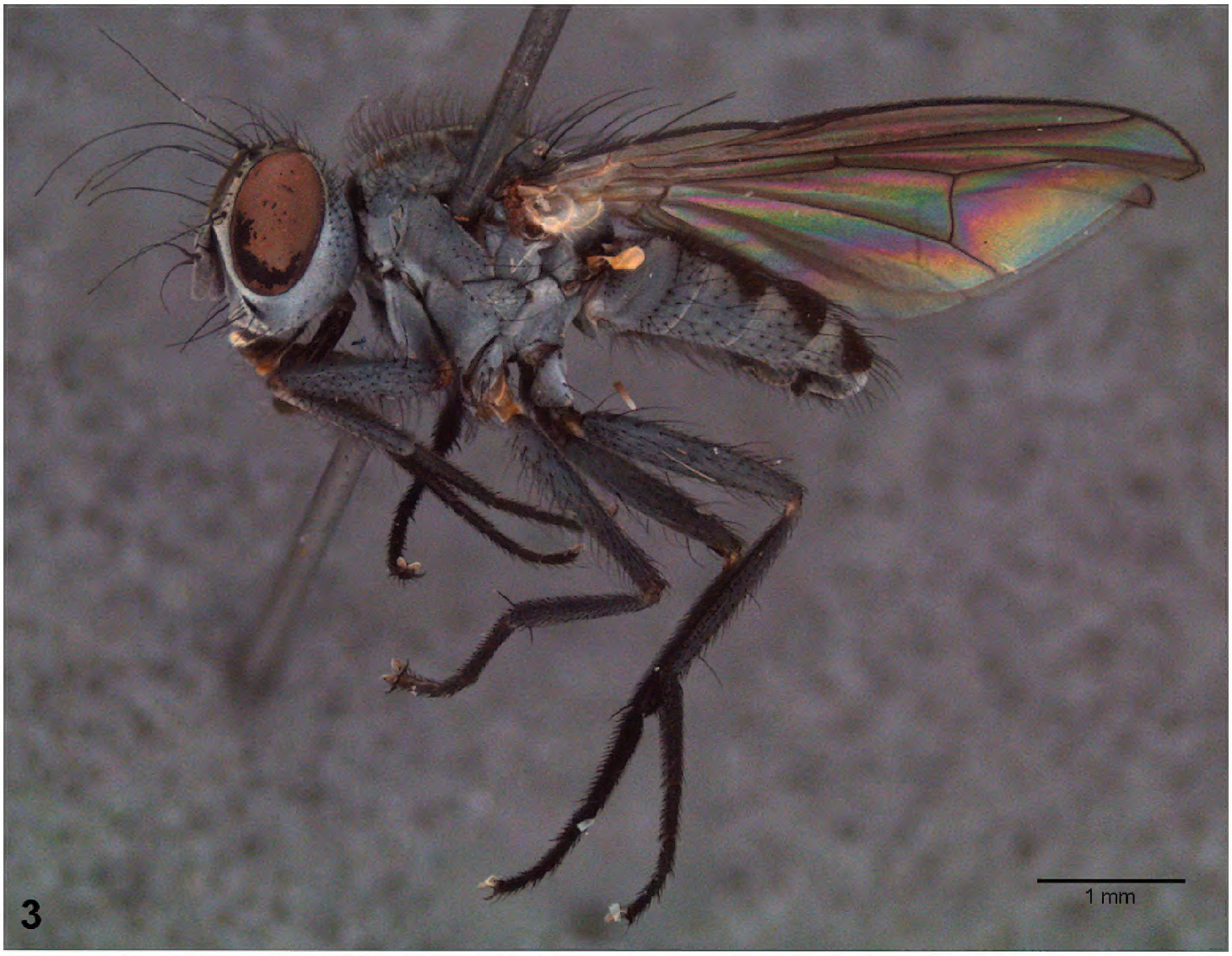
Taxonomy

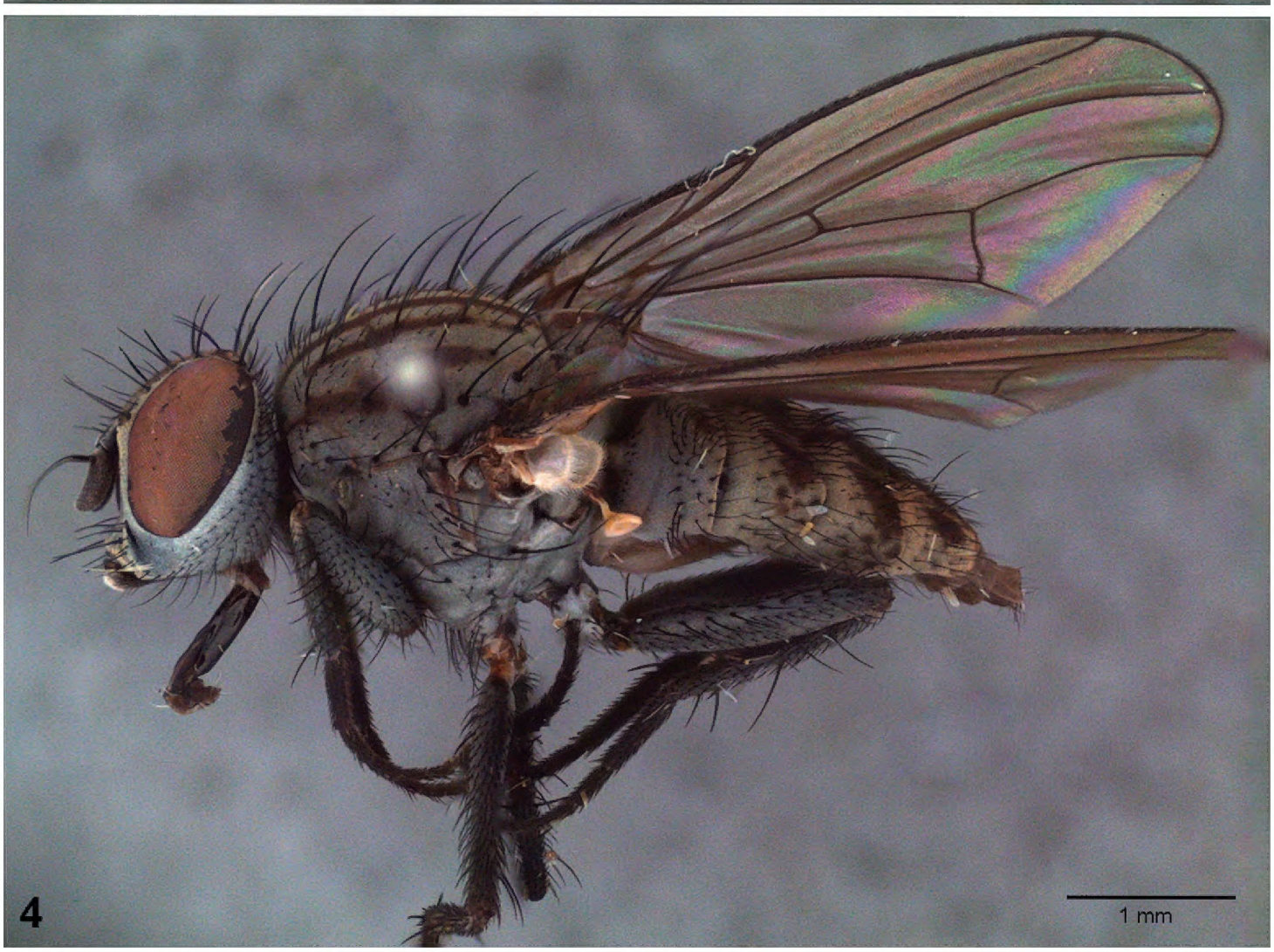
***Coenosia* Meigen, 1826**

***Coenosia flagelliseta* sp. nov.**
http://zoobank.org/B4FD391C-42EF-4FAA-8708-30BC9BD32E94
Figs 3, 4, 7, 8, 11, 12, 15, 16, 17–19, 26, 29, 30

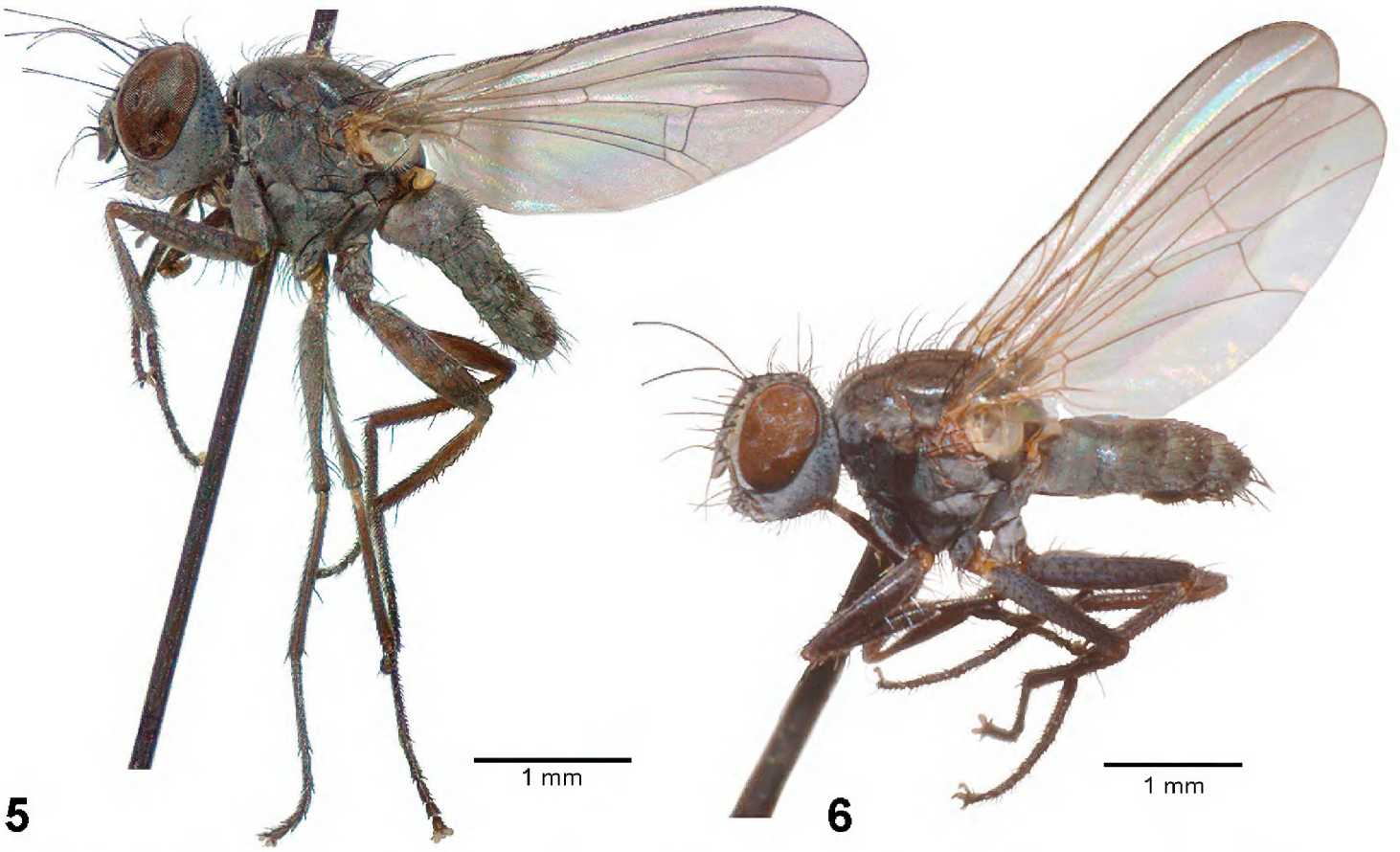
Etymology. From the Latin *flagellum* (whip) and *seta* (bristle) referring to the delicate whip-like setae and setulae covering the scutum of the males.

Diagnosis. Males can easily be distinguished from other species by their femora, pleura and scutum having some setae differentiated as delicate whip-like setulae, in combination with apically globular frontal and orbital setae. The female has the ovi-





Figures 3, 4. *Coenosia* spp. habitus, lateral view **3** *C. flagelliseta* sp. nov. ♂ **4** *C. flagelliseta* sp. nov. ♀.

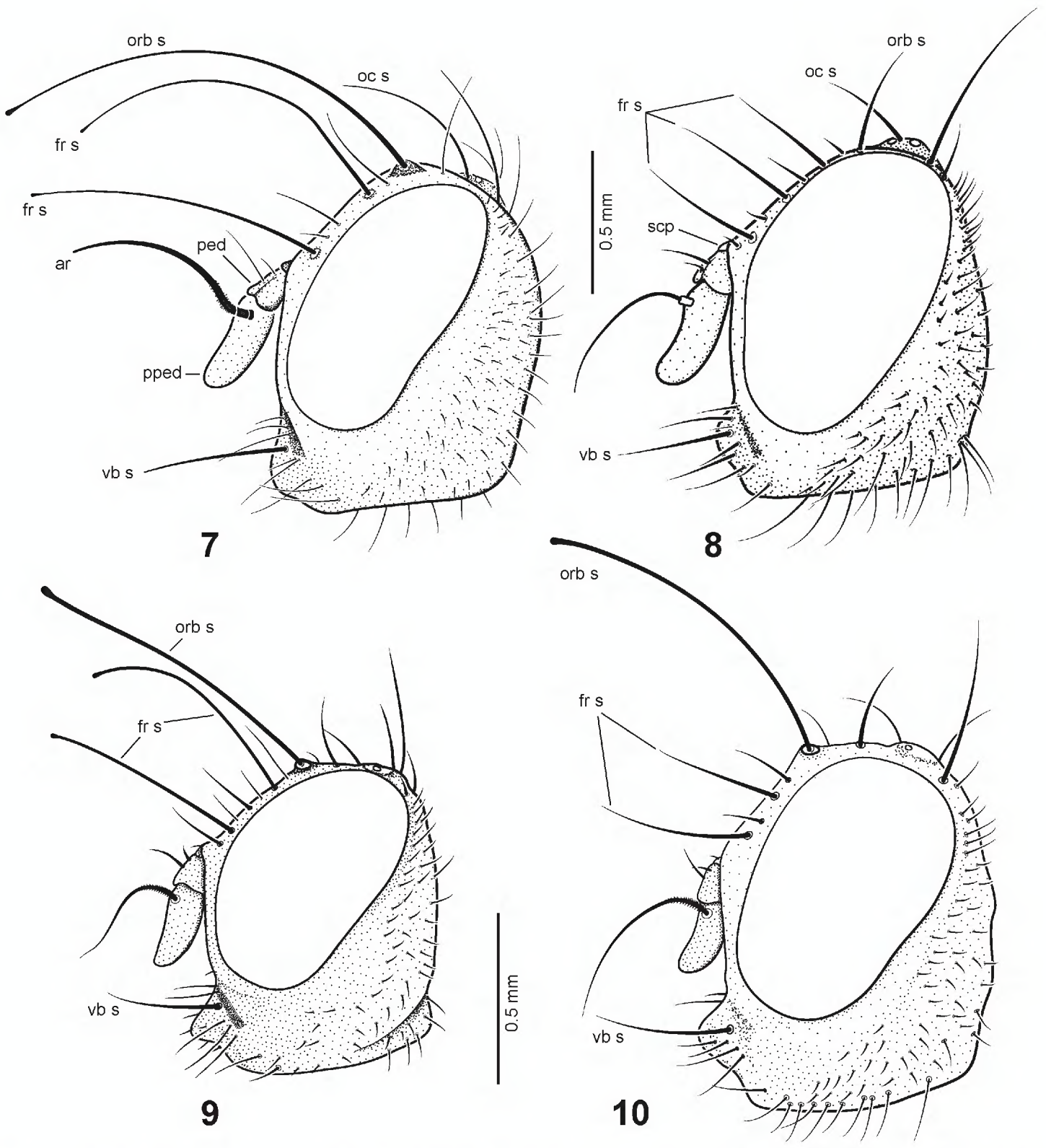


Figures 5, 6. *Coenosia* spp. habitus, lateral view **5** *C. macrotriseta* ♂ **6** *C. globuliseta* ♂. Figs **5, 6** reused (Muller and Miller 2013, figs 1A, B).

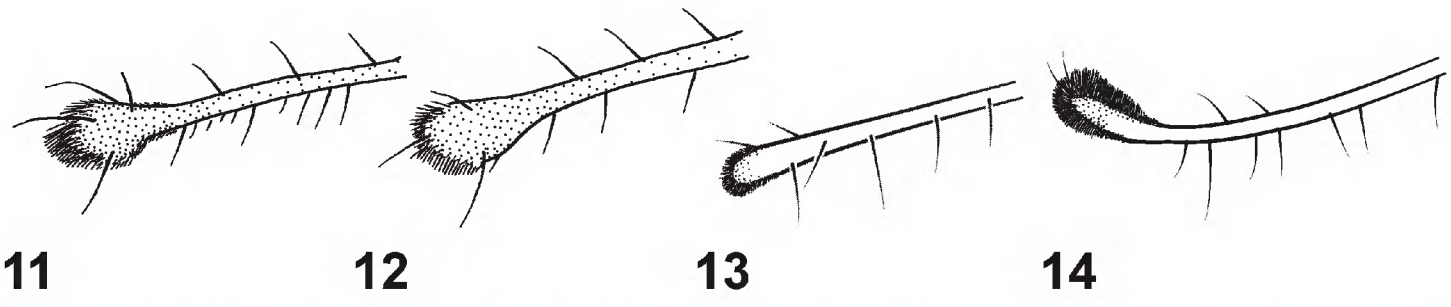
positor with an atypical tergite 6, which is a fused, broad plate with a basal emargination, compared to the typical and, up to now, considered synapomorphic, slender paired plates of other *Coenosia*.

Description. Male. Holotype ♂ measurements (mm): body length: 4.72; head: 0.92; thorax: 1.80; abdomen: 2.00; wing: 4.52; ratios (length/width): frontal plate 3.25.

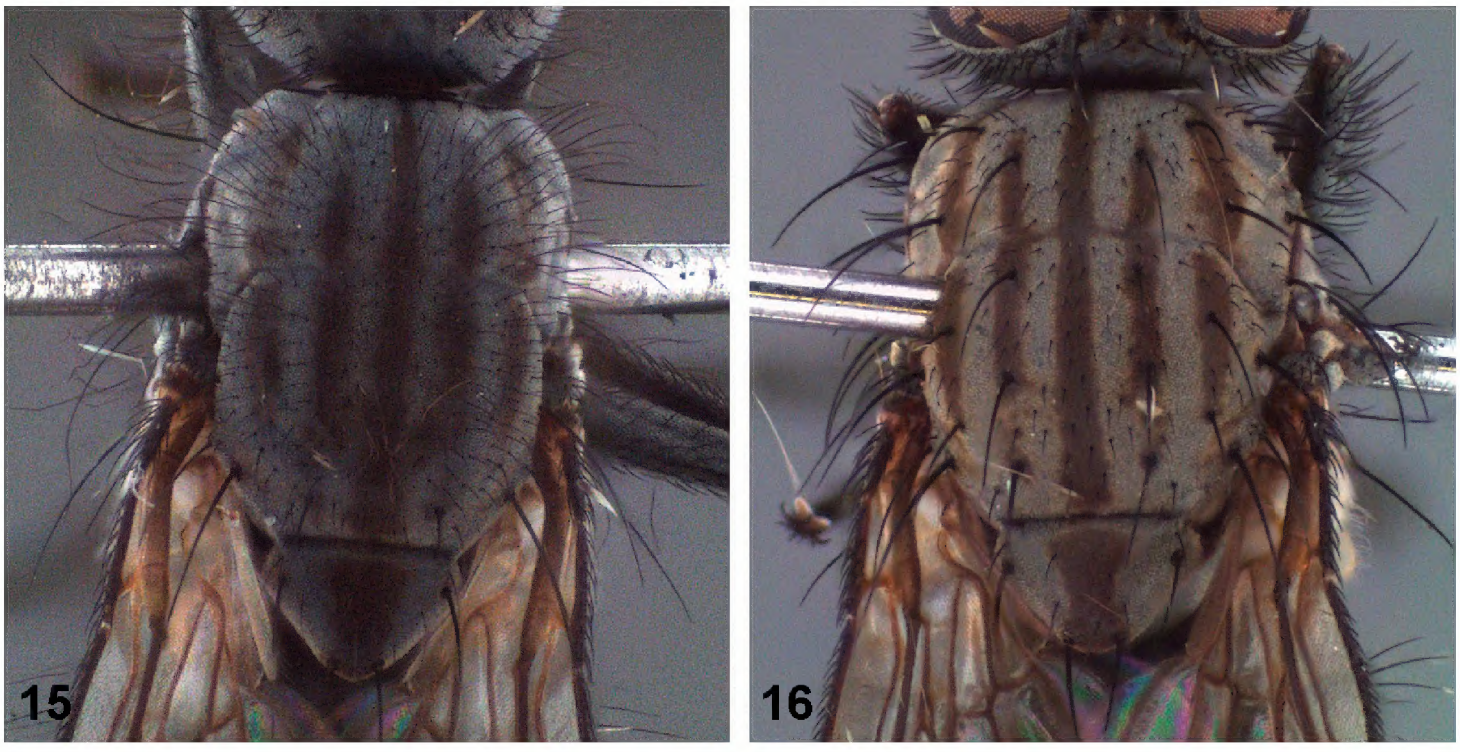
Head (Fig. 7): Dichoptic. Eyes bare and somewhat reduced taking up ca. 45% of lateral head surface. Antennal scape bare; pedicel with dorsal suture along its length, with one strong setula and one weak setula on the dorsal inner surface; postpedicel not reaching past bottom third of eye, ca. 2× length of pedicel. Arista located dorsally on postpedicel, bare. Palpus apically dilated (Fig. 11), dark brown in colour with apical gold-white hairs. Gena wide with dark marking apically, face projecting forwards. Mentum dark brown, glossy. Head grey-dusted throughout, with exception of silver-white-dusted frontal plate (black ground colour) and fronto-orbital plates. One pair of ocellar setae, 2× length of ♀ ocellar setae. One pair of exceptionally long, inclinate, apically globular orbital setae, situated on a glossy, raised, tubercle; two pairs of inclinate apically globular frontal setae; analogous middle pair of three pairs of frontal setae found in ♀ reduced to same length and appearance as interstitial setulae. One pair of divergent post-ocellar setae, less than ½ the length of ocellar setae. One pair each of inner vertical, outer vertical and paravertical setae, all appearing setulae-like, undifferentiated from each other in appearance except for inner vertical seta 2× outer vertical seta length. Three pairs of supravibrissal setulae, one pair of vibrissae, five pairs of subvibrissal setulae.



Figures 7–10. *Coenosia* spp. heads, lateral view **7** *C. flagelliseta* sp. nov. ♂ **8** *C. flagelliseta* sp. nov. ♀ **9** *C. macrotriseta* ♂ **10** *C. globuliseta* ♂. Figs **9, 10** modified (Muller and Miller 2013, figs 2A,B). Abbreviations: ar – arista; fr s – frontal seta; oc s – ocellar seta; orb s – orbital seta; ped – pedicel; pped – postpedicel; scp – scape; vb s – vibrissal seta.



Figures 11–14. *Coenosia* spp. palpi **11** *C. flagelliseta* sp. nov. ♂ **12** *C. flagelliseta* sp. nov. ♀ **13** *C. macrotriseta* ♂ **14** *C. globuliseta* ♂. Figs **13, 14** reused (Muller and Miller 2013, figs 3A,B).



Figures 15, 16. *Coenosia flagelliseta* sp. nov., scutum, dorsal view **15** male **16** female.

Thorax (Fig. 15): Grey dusted throughout, with five dark brown vittae (lighter brown compared to female), running along the dorsocentral, acrostichal and intra-alar setae; singular acrostichal vitta running to the apex of scutellum. Holotype with 11, paratype with 10 undifferentiated postpronotal setulae, all whip-like in appearance. Prosternum bare. Two notopleural setae of equal length. Two postalar setae, posterior postalar seta 2× length of anterior postalar seta. One pair of supra-alar setae. No strongly differentiated intra-alar setae. Dorsocentral setae 1+3. All setae on scutum, with the exception of the apical pair of postsutural dorsocentral setae and the postalar and supra-alar setae, appearing as delicate whip-like setulae, indistinguishable from other setulae on surface of scutum. All setulae on scutum whip-like in appearance (Fig. 15). Scutellum: One pair of apical setae, one pair of strongly developed sub-basal setae, ¾ the length of apical setae. One pair of weak basal setulae, no subapical setae and discal setal area restricted to six weak setulae. Subscutellum bare. Two proepisternal setae; two proepimeral setae, lower proepimeral seta downcurved; all proepisternal and proepimeral setae appearing setulae-like in appearance. Katepisternal setae forming an equilateral triangle (1:1:1), with 8 whip-like setulae inside the triangle; anterior and lower katepisternal setae also whip-like in appearance, the lower seta difficult to discern from surrounding setulae; posterior seta well-developed, not whip-like. Anepimeron, meron and katepimeron bare; katatergite with fine hyaline hairs, anatergite bare. Katepisternum with 5 whip-like delicate setae on posterior margin and scattered setulae across surface. Wing hyaline and bare, with no conspicuous chaetation or suffusions. Haltere yellow.

Legs: Grey, dusted appearance, except for pair of mid coxae with glossy posterior. Joints between femur, tibia and tarsal segments, as well as trochanters amber in colour.

Leg chaetation (standard appearance, i.e. not whip-like, unless stated otherwise): Fore femur with posterior surface covered in whip-like setulae, one posterodorsal seta, one posterodorsal row of whip-like setae. Fore tibia with one median posterior seta,

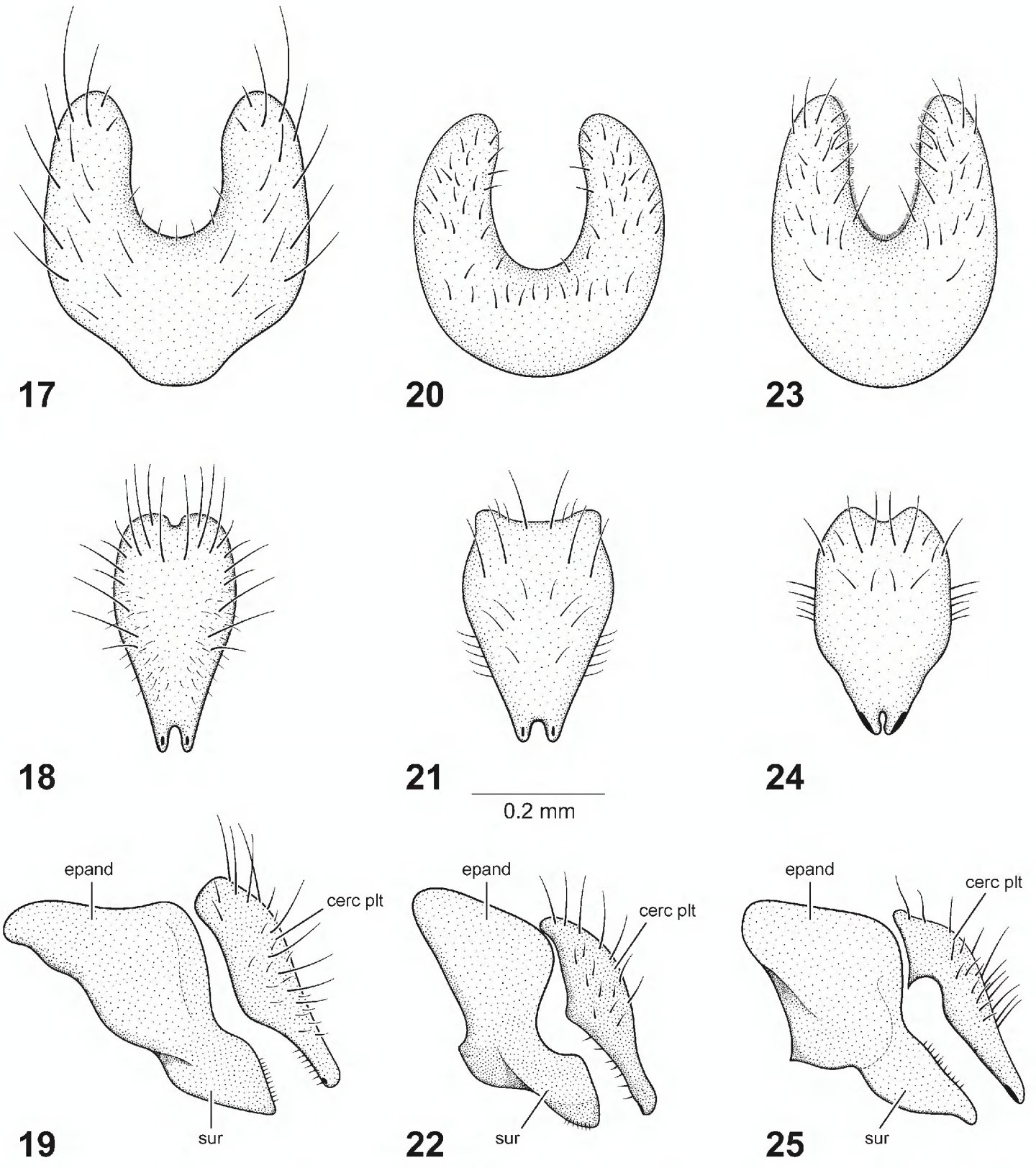
one dorsal preapical seta. Fore tarsus with one sub-basal ventral seta on basal segment. Mid femur with one supramedian anterior seta, one anterior row of whip-like setae, one supramedian posteroventral whip-like seta, one posteroventral row of whip-like setae. Mid tibia with one medial posterior seta, one preapical posterior seta, one preapical dorsal seta, one preapical posteroventral seta, one apical ventral seta, one apical dorsal seta. Hind femur with an antero- and posteroventral row of whip-like setae, one anterodorsal row of whip-like seta, one sub-basal anterodorsal seta, one supramedian anterodorsal seta, one sub-basal dorsal seta, one median anterodorsal seta, one sub-basal posteroventral seta, one median posteroventral seta, one preapical dorsal seta, one preapical ventral seta. Hind tibia with one median anterodorsal seta, one preapical dorsal seta, one apical ventral seta, one apical anteroventral seta. Fore, mid and hind basal and 2nd tarsal segments with ventral setulae appearing somewhat erect.

Abdomen and terminalia (Figs 17–19, 26): All tergites with dark, shiny, longitudinal markings, taking up most of dorsal surface. Sternite 1 with singular setulae at apex. Sternite 5 as in Fig. 17, with setulae covering the majority of surface of lobes. Cercal plate as in Fig. 18, with clear apical and basal emarginations, with pair of dark markings apically; cercal plate with long basal and dorsolateral setulae. Surstylus fused with epandrium (Fig. 19). Hypandrium tubular, with two flap-like structures on either side, hypandrial apodeme reduced. Phallapodeme rodlike. Distiphallus appearing straight, with infuscated margins. Pregonite as in Fig. 26. Postgonite elongated, with an apical tooth. Ejaculatory apodeme as in Fig. 26.

Female. Allotype ♀ measurements (mm): body length: 5.96; head: 0.96; thorax: 2.12; abdomen: 2.88; wing: 4.91; ratios (length/width): frontal plate 1.86.

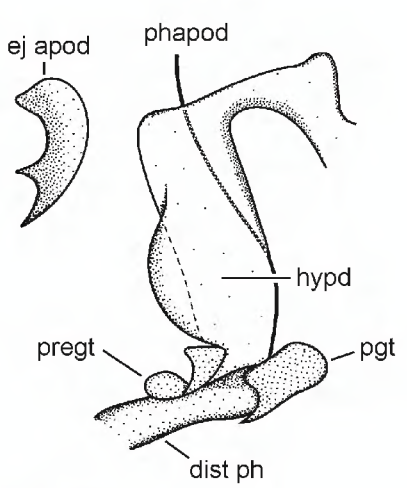
Head (Fig. 8): Dichoptic. Eyes bare and somewhat reduced taking up ca. 59% of lateral head surface. Antennal scape bare; pedicel with dorsal suture along its length, with one strong setula and one weak setula on the dorsal inner surface; postpedicel not reaching past bottom third of eye, ca. 2.5× length of pedicel. Arista located dorsally on postpedicel, bare. Palpus apically dilated (Fig. 12), dark brown in colour with apical white hairs. Gena wide with dark marking apically, face projecting forwards. Mentum dark brown, glossy. Head grey-dusted throughout, with exception of silver-white-dusted frontal plate (black ground colour) and fronto-orbital plates. One pair of ocellar setae, 0.5× length ♂ ocellar setae. Three pairs of inclinate frontal setae; one pair of reclinate orbital setae; one pair of short interstitial setulae between each of the frontal and orbital setae. One pair of divergent post-ocellar setae, same length as ocellar setae. One pair each of inner vertical, outer vertical and paravertical setae; inner vertical seta 3× outer vertical seta length, which in turn is 2× paravertical length. Three pairs of supravibrissal setulae, one pair of vibrissae, five pairs of subvibrissal setulae.

Thorax (Fig. 16): Grey dusted throughout, with five dark brown vittae (darker brown compared to male), running along the dorsocentral, acrostichal and intra-alar setae; singular acrostichal vitta running to the apex of scutellum. Two postpronotal setae and 9 setulae. Prosternum bare. Two notopleural setae of equal length. Two postalar setae with one interstitial setula, posterior postalar seta 2× length of anterior postalar seta, anterior postalar 4× the length of interstitial setula. One pair of supra-alar setae. Two presutural and two postsutural intra-alar pairs of setae. Dorsocentral setae 1+3.



Figures 17–25. *Coenosia* spp. ♂, terminalia. *C. flagelliseta* sp. nov. **17** sternite 5 **18** cercal plate, **19** surstylus and cercal plate, lateral view. *C. macrotriseta* **20** sternite 5 **21** cercal plate **22** surstylus and cercal plate, lateral view. *C. globuliseta* **23** sternite 5 **24** cercal plate **25** surstylus and cercal plate, lateral view. Figs **20–25** modified (Muller and Miller 2013, figs 6–8). Abbreviations: cerc plt – cercal plate; epand – epandrium; sur – surstylus.

Dorsocentral and acrostichal setae well developed compared to male. Scutellum: One pair of apical setae, one pair of strongly developed sub-basal setae, ¾ the length of apical setae. One pair of weak basal setulae. No subapical setae, discal setal area restricted to five weak setulae. Subscutellum bare. Two proepisternal setae. Two proepimeral setae, lower proepimeral setae downcurved. Three strongly developed katepisternal setae, forming an equilateral triangle (1:1:1) with six weak setulae inside the triangle; ante-



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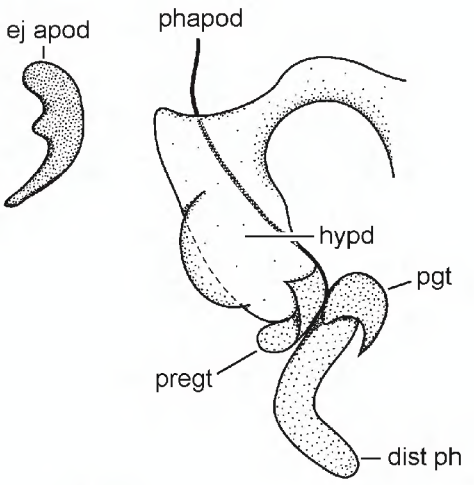

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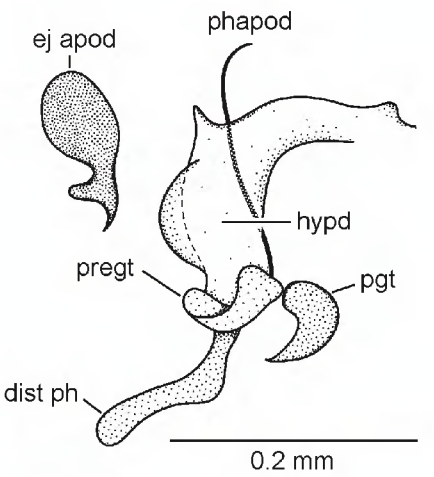

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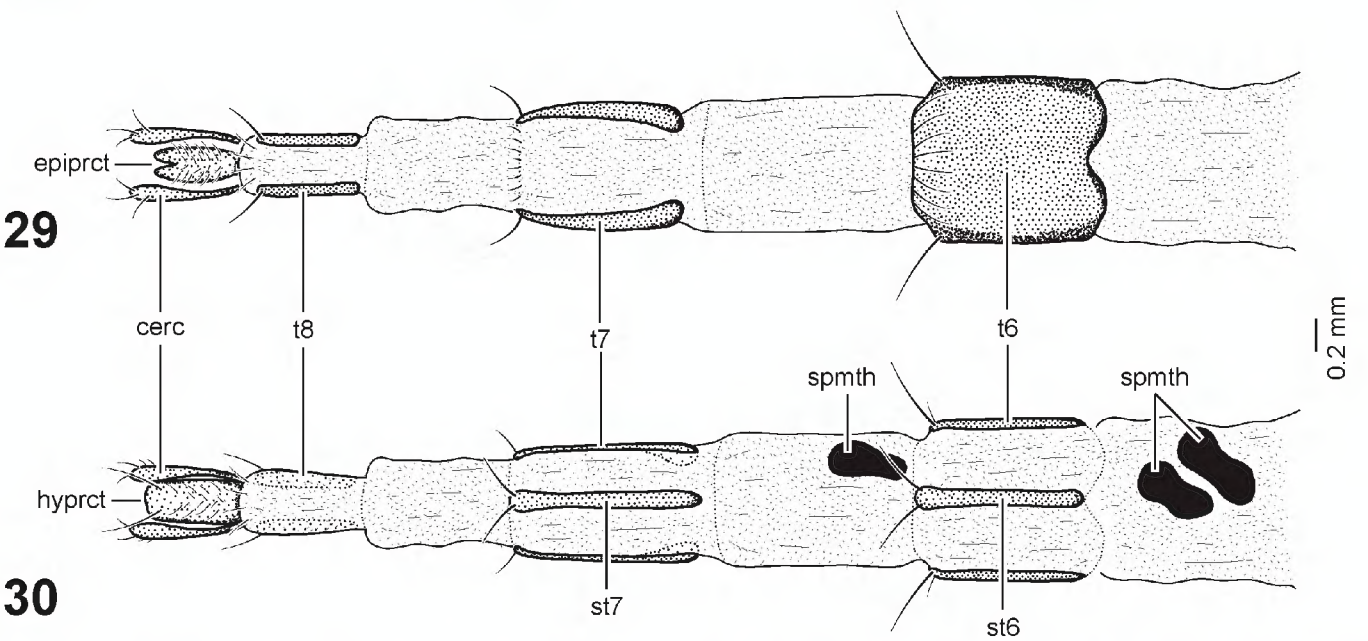

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Figures 26–30. *Coenosia* spp. ♂, phallic complex **26** *C. flagelliseta* sp. nov. **27** *C. macrotriseta* **28** *C. globuliseta. Coenosia flagelliseta* sp. nov. ♀, ovipositor **29** dorsal view **30** ventral view. Figs **27, 28** modified (Muller and Miller 2013, figs 9A, B). Abbreviations: cerc – cercus; distph – distiphallus; ej apod – ejaculatory apodeme; epiprct – epiproct; hypd – hypandrium; hyprct – hypoproct; pgt – postgonite; phapod – phallapodeme; pregt – pregonite; spmth – spermathecal; st – sternite; t – tergite.

rior and posterior katepisternal setae more strongly developed than lower. Anepimeron, meron and katepimeron bare; katatergite with fine hyaline hairs, anatergite bare. Katepisternum with five well-developed setae (compared to male) on posterior margin, with scattered setulae across surface. Wing hyaline and bare, with no conspicuous chaetation or suffusions. Haltere yellow.

Legs: Grey, dusted appearance, except for pair of mid coxae with glossy posterior. Joints between femur, tibia and tarsal segments, as well as trochanters, amber in colour.

Leg chaetation (all non-whip-like): Fore femur with one row each of posteroventral and posterodorsal setae. Fore tibia with one median posterior seta, two preapical posteroventral setae, one apical dorsal seta, one apical posterodorsal seta. Fore tarsus with one sub-basal ventral seta on basal segment. Mid femur with one supramedian anterior seta, one median anterior seta, one preapical posterodorsal seta, one preapical posterior seta, one supramedian ventral seta, one row of anteroventral setae; lacking anterior preapical seta. Mid tibia with one preapical dorsal seta, one apical ventral seta, one apical posteroventral seta, one apical anterior seta, one median seta, one su-

pramedian posterior seta, one median anterodorsal seta. Hind femur with a row of anterodorsal setae, one supramedian ventral seta, one supramedian posteroventral seta, one medial posteroventral seta, one basal dorsal seta, one basal posteroventral seta, one sub-basal posteroventral seta, one sub-basal anteroventral seta, one supramedian anteroventral seta, three subapical anteroventral setae. Hind tibia with one medial anterodorsal seta, one preapical anterodorsal seta, one apical anteroventral seta. Fore, mid and hind basal and 2nd tarsal segments with ventral setulae appearing somewhat erect.

Abdomen: All tergites with dark, shiny, longitudinal markings, taking up most of dorsal surface, markings split in middle by median vitta. Tergites 3 and 4 with some laterally situated setae having dark markings around bases, as an extension of the aforementioned longitudinal markings. Sternite 1 bare. Ovipositor as in (Figs 29, 30). Sternites 6, 7, tergites 7, 8 slender plates; sternite 8 absent; tergite 6 one broad plate with a basal emargination. Three spermatheca, pear-shaped. Hypoproct with a pair of preapical setulae ca. half its length, epiproct apically emarginate.

Type locality. RSA [SOUTH AFRICA]: Mpumalanga, Mariepskop State Forest, Radar station road at: 24.5466S, 30.8646E; 26–28.i.2017; 1,885 m a.s.l.; Kirk-Spriggs, A.H. & Muller, B.S.; Malaise trap over ravine, Northern Escarpment Afromontane Fynbos.

Type specimens. ***Holotype*** ♂, micro-pinned. Original label [// indicates label; / indicates line break]: "RSA: Mpumalanga / Mariepskop State Forest / Radar station road at: / 24.5466°S, 30.8646°E / 26–28.i.2017, 1,885 m [a.s.l.] / Kirk-Spriggs & Muller // Malaise trap / over ravine / Northern Escarpment /Afromontane Fynbos // Holotype ♂ / *Coenosia flagelliseta* sp. nov. / B.S. Muller 2019 [red label] // BMSA(D) / 02271 // BMSA type / no. 306 [red label]. [Specimen deposited in the National Museum, Bloemfontein, South Africa].

Paratype ♀, micro-pinned, genitalia dissected, stored together with abdomen in vial under specimen. Same data as for Holotype. Paratype ♀ / *Coenosia flagelliseta* sp. nov. / B.S. Muller 2019 [red label]// BMSA(D) / 02273 // BMSA type / no. 307 [red label]. [Specimen deposited in the National Museum, Bloemfontein, South Africa].

Paratype ♂, micro-pinned, genitalia dissected, stored together with abdomen in vial under specimen. Same data as for Holotype. Paratype ♂ / *Coenosia flagelliseta* sp. nov. / B.S. Muller 2019 [red label]// NMSA-DIP / 132993 // NMSA type / no. 2937 [red label]. [Specimen deposited in the KwaZulu-Natal Museum, Pietermaritzburg, South Africa].

Distribution. South Africa. Only known from type locality.

Coenosia macrotriseta Muller & Miller, 2013

Figs 5, 9, 13, 20–22, 27

Diagnosis. Males with two pairs of frontal and one pair apically globular orbital setae. Frontal plate and frontal-orbital plates silver-white dusted. Dorsocentral setae (with the exception of the postsutural posterior pair) appearing setulae-like, making them almost indistinguishable from the preceding and surrounding setulae. Trochanters dark amber in colour. Preapical dorsal and anterodorsal setae on hind tibia absent.

Material examined. ***Holotype:*** SOUTH AFRICA • ♂;Western Cape, Oudtshoorn district, Moeras-River Farm (209); 33°48'S, 22°03'E; 525 m [a.s.l.]; Early September 2007 [ix.2007]; G.P.B. Davies; Dry Karoo scrub with flowers; [red label, red ink] Holotype ♂ 1806; *Coenosia macrotriseta* sp. nov., det. B. Muller 2013; NMSA-Dip. 70333. NMSA type no. 1806.

Genitalia dissected, with abdomen in vial under specimen.

Distribution. South Africa. Only known from type locality.

Coenosia globuliseta Pont, 1980

Figs 6, 10, 14, 23–25, 28

Coenosia globuliseta: Pont 1980: 755 [replacement name].
Coenosia longiseta Zielke, 1971: 301 [junior homonym of *C. longiseta* Stein, 1906].

Diagnosis. Males with one pair apically globular orbital setae, frontal setae not specialised. Frontal plate and fronto-orbital plates golden-silver dusted. Trochanters and knees orange. Preapical dorsal and anterodorsal setae on hind tibia absent.

Material examined. ***Holotype:*** SOUTH AFRICA • ♂; KwaZulu-Natal, Cathedral Peak area [28.9502S 29.2053E, max. uncertainty 2.5 km], Natal Drakensberg; Alt. 7700 ft [a.s.l.]; 20 Mar. 1955 [20.iii.1955]; B. Stuckenberg; [red label] Holotype, *Coenosia longiseta* sp. nov., det. E. Zielke 1969; NMSA-Dip. 37487; NMSA type no. 1750.

Genitalia dissected, with abdomen in vial under specimen.

Distribution. South Africa. Only known from type locality.

Discussion

All three species key to the *C. semifumosa* group using the key provided by Emden (1940). However, none can be keyed out past couplet 5 "Hind tibia with two preapical setae (an ad [anterodorsal] and a d [dorsal] one)". *Coenosia flagelliseta* sp. nov. has a preapical dorsal seta on its hind tibia, but no preapical anterodorsal seta, whilst *C. globuliseta* and *C. macrotriseta* have neither a preapical dorsal or anterodorsal seta. The three species could be considered to form a separate group, based on the presence of one pair of apically globular orbital setae, thus far unique to *Coenosia* or any other muscid known to the author, herein designated as the "*globuliseta*-group". The pair of orbital setae in the males appears somewhat proclinate and not reclinate as in other Coenosiini. The female of *C. flagelliseta* sp. nov. however does have a pair of reclinate orbital setae. All three species also have broad gena and unusually projecting facial margins, which could also help identify the group when occurring in combination with the apically globular orbital setae in the males.

The female of *C. flagelliseta* sp. nov. has tergite 6 as a broad plate with a basal emargination. This is in contrast to the general ground plan of the *Coenosia* as treated in Couri and Pont (2000) in their cladistics analysis, which scored character 66, the shape

of female tergites 6 and 7, as (0) one broad plate; (1) 2 broad plates or (2) 2 intermediate to slender plates. Two slender plates are viewed as a synapomorphy of *Coenosia*. The species in the "*globuliseta*-group" should thus be treated as aberrant and an exception to the generally accepted *Coenosia* ground plan.

Vegetation

All three species are interestingly disjunct in their distribution (Fig. 31) and habitat, with *C. flagelliseta* sp. nov. and *C. macrotriseta* being the most morphologically similar of the three species, but the furthest removed.

Coenosia flagelliseta sp. nov. was collected on top of Mariepskop, Mpumalanga, South Africa in a ravine (Figs 1, 2), within vegetation classified as Northern Escarpment Afromontane Fynbos. This vegetation type is considered restricted and quite fragmented, with a distribution from the Thabakgolo Mountains, southwards along the highest peaks only, through Mariepskop, God's Window and as far south as the Graskop area, typically at altitudes between 1,600–1,900 m a.s.l. with some outliers as low as 1,300 m.

Coenosia globuliseta was collected in 1955, with little locality information available apart from its being collected in the "Cathedral Peak area". Considering current vegetation maps (Mucina and Rutherford 2006), it could potentially occur in Drak-

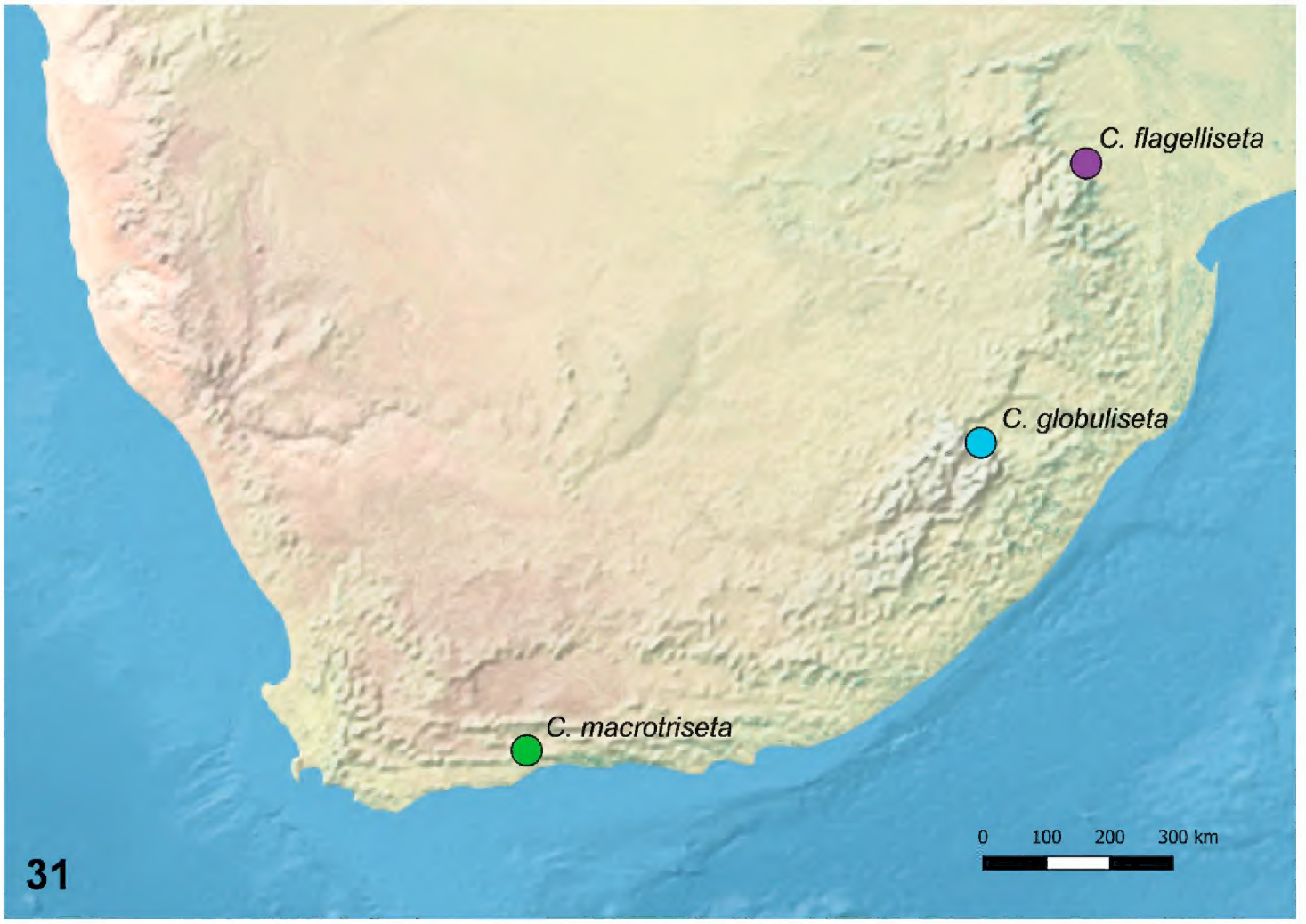

Figure 31. Distribution map of *Coenosia flagelliseta* sp. nov., *C. macrotriseta* and *C. globuliseta* in South Africa.

ensberg-Amathole Afromontane Fynbos, Ukhahlamba Basalt Grassland or Northern Drakensberg Highland Grassland vegetation types. The Fynbos component at Cathedral Peak is fragmented and only at much higher, sloped elevation (above 1,600 m a.s.l.) than the grassland vegetation close to potential sampling sites (ca. 1,300–1,500) m a.s.l. At present, it can only be speculated as to where the specimen was sampled.

Coenosia macrotriseta was sampled much more recently (2007) with its exact coordinates recorded, occurring in Northern Outeniqua Sandstone Fynbos, which occurs below 1,300 m a.s.l.

Feeding behaviour

Coenosia are regarded as obligate predators, but interestingly both the male and female of *C. flagelliseta* sp. nov. had nectar in their midgut contents, pointing to atypical feeding behaviour. Published accounts of *Coenosiini* as nectar feeders and pollinators are somewhat sparse, especially for South Africa. Brand (2014: Appendix B, xv) did, however, record three unidentified species of *Coenosia* on onion umbels and in yellow pan traps. This behaviour should ideally be further investigated in the future, as it expands the role of these flies to potential pollinators in Fynbos and could help elucidate the species' relationships within the group and their habitats.

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